MAMMALIAN SPECIES No. 208, pp. 1–4, 3 figs.

Idionycteris phyllotis.

By Nicholas J. Czaplewski

Published 15 December 1983 by The American Society of Mammalogists

Idionycteris Anthony, 1923

Idionycteris Anthony, 1923:1. Type species *Idionycteris mexicanus* Anthony [=*Corynorhinus phyllotis* Allen].

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Vespertilionidae, Subfamily Vespertilioninae, Group Plecotini (Williams et al., 1970). The genus *Idionycteris* includes one species, treated below.

Idionycteris phyllotis (Allen, 1916)

Allen's Big-eared Bat

Corynorhinus phyllotis Allen, 1916:352. Type locality San Luis Potosí, near the city of San Luis Potosí, Mexico.

Idionycteris mexicanus Anthony, 1923:1. Type locality "Miquihauna, Province of Tamaulipas, Mexico."

CONTEXT AND CONTENT. Context is given in the generic summary above. No subspecies are recognized (Genoways and Jones, 1967).

DIAGNOSIS. This diagnosis applies to both genus and species (modified from Handley, 1959:129). A pair of lappets projecting over the forehead from the anterior bases of the ears is the diagnostic characteristic of *I. phyllotis* (Fig. 1). These appendages are enlargements of the accessory anterior basal lobe of the auricle (pinna). *Idionycteris* closely resembles its relative *Euderma* but differs in coloration, the presence of lappets, and the presence of three lower premolars rather than two. The genus differs from its relative *Plecotus* (subgenera *Plecotus* and *Corynorhinus*) in having lappets, keeled calcars, and nostrils that are not elongated posteriorly.

GENERAL CHARACTERS. *Idionycteris* is a moderate-sized (8 to 16 g) bat with large ears. Dorsal pelage is long (10 mm) and soft, basally blackish with tips a contrasting yellowish gray; a blackish patch appears at each shoulder (Anderson, 1972). Specimens in worn pelage appear darker dorsally, having lost the paler tips of hairs. A tuft of white hairs occurs at the posterior base of each ear. Ventral hairs are black basally with pale buffy tips. Dorsal pelage does not extend onto wing membranes; only a few scattered hairs occur on the basal surface of the uropatagium. Glandular masses on the muzzle are not enlarged noticeably. The nostrils are unspecialized. A low keel is present on the calcar. The uropatagium has 12 to 13 transverse ribs and is attached to the hindfoot at the junction of the metatarsus and the proximal phalanx of the first digit. The supraorbital region of the skull (Fig. 2) is ridged sharply and the temporal ridges do not coalesce to form a sagittal crest. The rostrum is broad, flattened, and with a pronounced middorsal concavity. The braincase is broad and shallow. The zygomatic arch bears a postorbital expansion in its middle third. No median postpalatal process is present. The auditory bullae are greatly enlarged and slightly elongated in outline (Anthony, 1923; Handley, 1959).

The dental formula is i 2/3, c 1/1, p 2/3, m 3/3, total 36. The first upper incisor bears an accessory cusp near the base of the tooth; the second is simple. The lower incisors are trifid. Upper and lower canines are of normal height and simple. On the lower canines the cingulum rises anteriorly to form a distinct notch adjacent to the outer incisor. The first upper premolar is small, barely exceeding the cingulum of the canine in height, and is crowded between the canine and the second premolar but is within the line of the toothrow; the second upper premolar bears a main cusp slightly higher than cusps of the molar series and the tooth is wider than it is long. In the lower jaw, the first premolar is smaller than the third, and the second is smaller than the first. The third lower premolar is single-rooted. The first and second upper molars are subequal in size and have typical W-shaped ectolophs. The third upper molar is about half as large as the first or second and has a third commissure (premetacrista) equal to or longer than the second commissure (postparacrista); the metacone of M3 is fairly prominent, and a fourth commissure (metacrista) may be barely indicated. The lower molars are subequal in size and normal in pattern (Anthony, 1923; Handley, 1959). The deciduous dentition is unknown.

Measurements (in mm) are: total length, 103 to 118; length of tail, 44 to 55; length of hindfoot, 9 to 12; length of ear, 34 to 43; length of tragus, 12 to 14; length of forearm, 41.8 to 49.0; greatest length of skull, 16.6 to 17.4; breadth of braincase, 8.7 to 9.2; length of maxillary toothrow, 5.3 to 6.3 (Anderson, 1972; Anthony, 1923; Genoways and Jones, 1967; Hall, 1981; Handley, 1959). In the study by Williams and Findley (1979), females were about 5% larger than males in head and body length, but no differences between the sexes were found in forearm length, condylocanine length, and length of maxillary toothrow.

The preliminary study by Genoways and Jones (1967) showed some geographic variation in external and cranial size and slight geographic variation in pelage color, but these authors found no evidence to justify nomenclatorial recognition of more than one taxon.

DISTRIBUTION. Allen's big-eared bat inhabits mountainous regions of the southwestern United States and Mexico (fig. 3) from Mojave Desert scrub to fir forest, in the vicinity of rocks. In the southwestern United States, most specimens are from the southern Colorado Plateau, Mogollon Rim, and adjacent mountain ranges. In Mexico, scattered records are all from the Sierra Madre Occidental, Sierra Madre Oriental, and Sierra Volcánica Transversal. The species occupies an elevational range from 855 m (2,600 ft) to 3,225 m (9,800 ft), but most specimens are from altitudes between 1,100 m (3,500 ft) and 2,500 m (7,500 ft) (Genoways and Jones, 1967). There is no fossil record for *Idionycteris*.

FORM AND FUNCTION. *Idionycteris phyllotis* has the external morphology of many gleaning bats (those that pluck stationary insects from surfaces), with long ears and tragi, wings adapted for highly maneuverable and hovering flight (Findley et al., 1972), and the gracile jaw of a soft-insect eater (Freeman, 1981). Farney and Fleharty (1969) published a wing outline drawing and gave wing-character values for female *I. phyllotis* as follows (values given are mean ± standard error of mean, and extremes in parentheses): wing span, 323.1 ± 4.5 mm (302 to 344); wing area, 160.7 ± 3.3 cm^2 (144.2 to 177.8); tail area, 24.0 ± 1.6 cm^2 (20.2 to 27.6); aspect ratio, 6.5 ± 0.13 (6.1 to 7.5). This species and other plecotine bats have a relatively low aspect-ratio wing with a large tip (chiropatagium) (Findley et al., 1972).

In Freeman's (1981) morphometric study of dental and jaw characters of insectivorous bats, Principal Components Analysis ar-

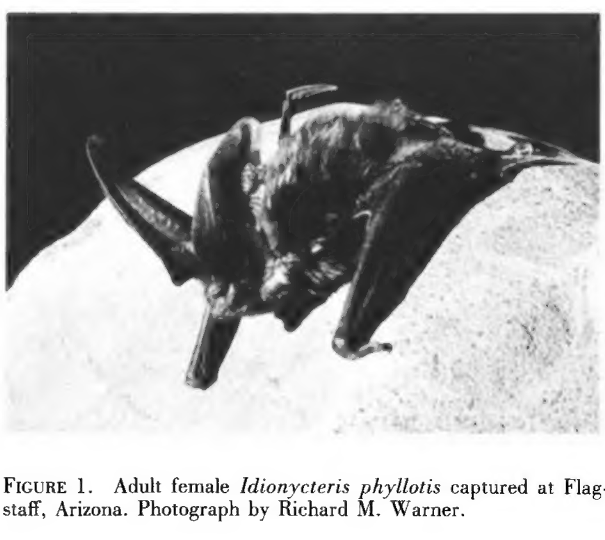

FIGURE 1. Adult female *Idionycteris phyllotis* captured at Flagstaff, Arizona. Photograph by Richard M. Warner.

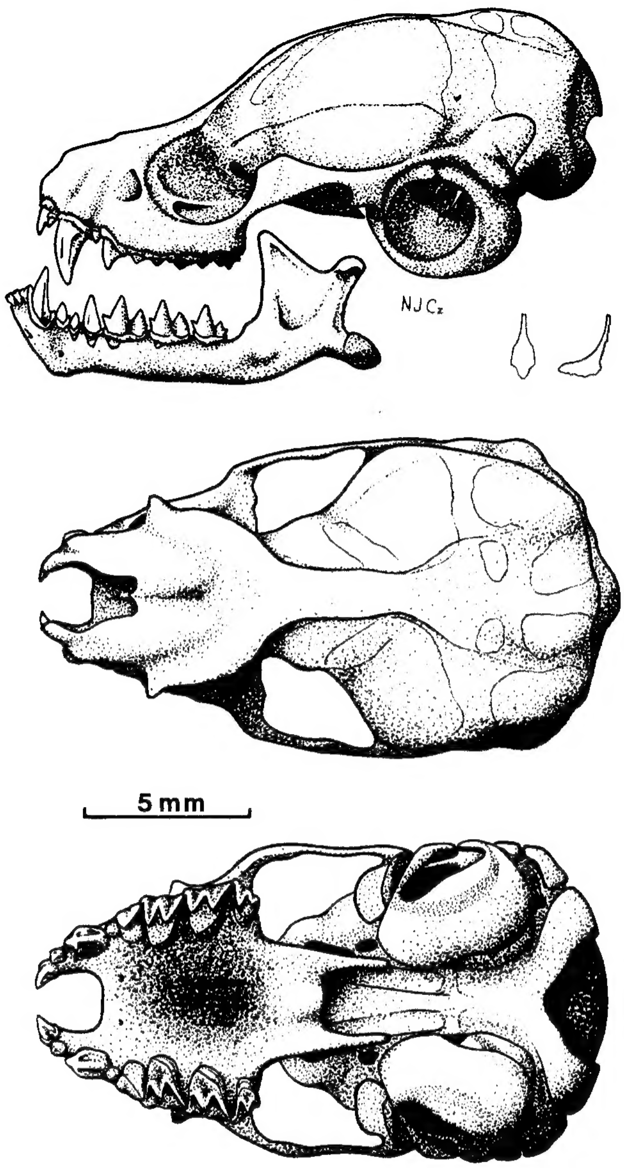

FIGURE 2. Lateral, dorsal, and ventral views of cranium, lateral view of mandible, and dorsal and lateral views of baculum of a male *Idionycteris phyllotis* (Museum of Northern Arizona no. Z9.2419) from Shiva Temple, Grand Canyon, Arizona, 2,390 m.

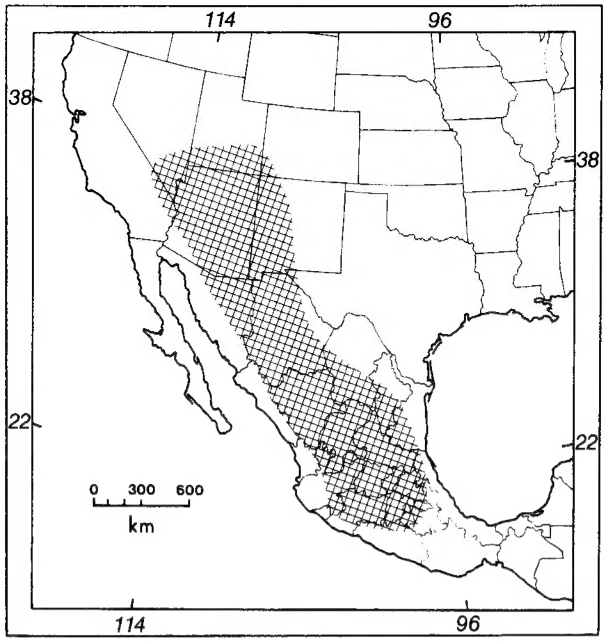

FIGURE 3. Geographical distribution of *Idionycteris phyllotis* in southwestern North America.

rayed *I. phyllotis* with bats having relatively gracile skulls, thereby predicting that it was among those that eat soft-bodied insects. Her prediction is upheld by published diet information for this bat.

Handley (1959) considered *Idionycteris* to be the most generalized and primitive of the plecotine bats with regard to dental, osteological, and external characters. He also considered it to be most like *Euderma*.

Based on predictions from renal morphology (ratio of kidney inner medulla thickness to cortex thickness = 4.1), Geluso (1980) estimated the maximum urine concentration of *Idionycteris* at 2,950 mosmol/kg. This is a relatively low value, similar to urine concentrating abilities of many bat species restricted to mesic habitats.

The baculum is saddle-shaped with a strong dorsal curvature in lateral view, and bears a long anterodorsal projection (Fig. 2). A broad longitudinal groove for the urethra occurs on its ventral surface.

REPRODUCTION. Pregnant females were collected in June in New Mexico, Arizona, and Durango. All bore a single embryo (Findley et al., 1975; Gardner, 1965; Jones, 1961). Lactating females were reported from the second week of June until the first week of August (Cockrum and Musgrove, 1964; Findley and Jones, 1961; Findley et al., 1975; Gardner, 1965; Jones, 1961). Flying young were reported as early as 31 July (Cockrum and Musgrove, 1964).

Females segregate from males during the summer to form maternity colonies (Williams and Findley, 1979). Two such colonies, consisting of 25 and 97 individuals, respectively, were found in mine tunnels in low, open desert in western Arizona (Cockrum and Musgrove, 1964). Another maternity colony consisting of approximately 30 individuals was situated within a 30-m-high pile of boulders fallen from the roof of a large open-fronted grotto. This rubble pile was situated in a canyon with riparian vegetation that coursed through desert grassland (Commissaris, 1961).

Little reproductive information is available for males. Jones (1961) examined two taken in New Mexico on 20 June and found no mature sperm in the testes or epididymides. Males with enlarged testes were not reported, but two specimens taken on 26 June in Chihuahua and on 31 July in Nuevo León had testes 2.5 mm long and 4 × 2 mm, respectively (Genoways and Jones, 1967). A male described as "scrotal" was found in Utah on 25 June (Poche, 1975).

ECOLOGY. Allen's big-eared bats are primarily dwellers of forested mountainous areas, from pine (*Pinus*), fir (*Abies*), and oak (*Quercus*) forests down to riparian woodlands of sycamore (*Platanus*), cottonwood (*Populus*), willow (*Salix*), and walnut (*Juglans*) (Commissaris, 1961; Findley et al., 1975; Genoways and Jones, 1967; Hayward and Johnson, 1961; Jones, 1965). Occasionally, specimens were taken in more arid habitats. In Utah, Poche (1975) collected one in a desert wash with saltcedar (*Tamarix pentandra*) and willows, where blackbrush (*Coleogyne ramosissima*) and infrequent junipers (*Juniperus osteosperma*) and piñon (*Pinus edulis*) grew on surrounding uplands. Cockrum and Musgrove (1964) collected them in western Arizona in Mojave Desert scrub with Joshua trees (*Yucca brevifolia*), Mojave yucca (*Yucca schidigera*), shrub live oak (*Quercus turbinella*), beavertail cactus (*Opuntia basilaris*), and catclaw acacia (*Acacia greggii*). Gardner (1965) caught specimens in Durango in mesquite (*Prosopis*)-grassland with scattered oaks.

At almost all capture sites, rocks were present in the vicinity either as cliffs, outcroppings, boulder piles, or lava flows. These bats probably roost in such sites. The only available information on roosting sites is that given for maternity roosts. Other species of bats associated with these maternity roosts were *Plecotus townsendii* and *Myotis thysanodes*.

Food consists primarily of moths (microlepidopterans, 6 to 12 mm long), but soldier beetles (Cantharidae), dung beetles (Scarabeidae), leaf beetles (Chrysomelidae), roaches (Blattidae), and flying ants (Formicidae, including *Eciton*) are eaten also (Black, 1974; Ross, 1967). Most food probably is gleaned from vegetation or other

surfaces or is taken in flight by individual pursuit. The presence of flying ants in the diet implies opportunistic feeding (Ross, 1967).

In a study of parasitic helminths of bats, Cain and Studier (1974) examined four *I. phyllotis* from Nevada. They found no blood parasites or other endoparasites. No ectoparasites were reported for *I. phyllotis* but one specimen examined by Ross (1967) had eaten a flea (*Myodopsylla collinsi*: Myodopsyllidae) that might have parasitized the animal. No predators of *I. phyllotis* are known. The maximum longevity recorded for the species was at least 3 years 2 months for a female (Cockrum, 1973).

BEHAVIOR. Most specimens were captured in mist nets over water holes as the bats came in to drink; capture times range from 2005 h (Jones, 1961) to 0400 h (O'Farrell and Bradley, 1969). Most were taken between 1.5 and 2 h after sunset, but this may simply reflect the time during which biologists had nets in place.

During open-air direct flight, the bats emit rather loud "peeps" at about 1-s intervals (Barbour and Davis, 1969; Jones, 1961). Jones (1961) noted that their voice was similar to that of *Euderma maculatum* but lower in pitch. While flying over a desert tank, they also emitted "a very rapid cheeping, verging almost to a rapid clicking" (Hayward and Johnson, 1961) or a "low, barely audible cheeping" (Commissaris, 1961) much like that of *Plecotus townsendii.*

Echolocation sounds of *I. phyllotis* were studied in some detail by Simmons and O'Farrell (1977). The bat uses long-constant frequency (CF)/modulated frequency (FM) sounds and FM sonar sounds in different situations. The CF component in long-CF/FM sounds occurs at 27 kHz and has a duration of 20 to 200 ms. The FM component sweeps down from 24 to 12 kHz, with a prominent second harmonic from 40 to 22 kHz. This second harmonic sweep is interrupted at 28 to 25 kHz, providing a notch in the spectrum of the FM component at the CF frequency. This notch probably permits isolation of CF and FM components in echoes for separate processing, thus avoiding mutual interference with the different kinds of target information the two components convey. The FM component also is used without the CF component as a sonar sound. Two other FM orientation sounds are used when the bat is in a confined space such as a room. One contains only the second and fourth harmonics of the 24 to 12 kHz fundamental sweep, whereas the other contains only the fifth harmonic (Simmons and O'Farrell, 1977). The signals of *I. phyllotis* encompass the range of signal types used by nearly all bat species (Simmons and Stein, 1980; Simmons et al., 1979). This allows the bat considerable versatility for using many different kinds of orientation sounds in diverse situations.

In close quarters the species flies slowly, is highly maneuverable, able to hover, and even can fly vertically. In open-air situations the animal uses fast, more direct movements from one place to another (Barbour and Davis, 1969; Commissaris, 1961; Jones, 1961). Such variable modes of flight and echolocation apparently are highly adaptive in a bat that is a "between, within, and below-canopy forager" (Black, 1974). While foraging in the complex acoustical environment of the forest canopy, they are required to utilize slow, maneuverable, searching flight and long-CF/FM sounds, but they may switch to swift, direct movements and FM signals to quickly locate and reach another patch of trees in which to forage (Warner, 1982).

These bats are docile in nature and rarely attempt to bite when handled. They often protect their huge ears by coiling them back along the sides of the neck in the "ram's horn" pattern characteristic of other plecotine bats (Commissaris, 1961; Hayward and Johnson, 1961). The sexes segregate geographically during the summer months (Williams and Findley, 1979), with females gathering into maternity colonies and males possibly remaining solitary, roosting elsewhere. Seasonal movements and cold-season whereabouts and activities of the species are unknown. All Mexico specimens were collected in summer months (between 8 June and 3 August) except for the type specimen, which was taken on 24 March (Anderson, 1972; Bogan and Williams, 1970; Carter et al., 1966; Gardner, 1965; Genoways and Jones, 1967; Handley, 1959).

GENETICS. The diploid number (2n) of chromosomes in Allen's big-eared bat is 30, with a fundamental number (FN) of 50. Autosomes consist of 11 pairs of metacentrics and submetacentrics grading in size from large to small, one pair of medium-sized acrocentrics, and two pairs of minute acrocentrics. The X chromosome is a medium-sized submetacentric and the Y is a small acrocentric chromosome (Baker and Mascarello, 1969). Among plecotine bats, the standard karyotype of *I. phyllotis* most closely resembles that of *Euderma maculatum* (Williams et al., 1970).

Bickham (1979) provided a G-banded karyotype for *I. phyllotis* and compared it with that of *Plecotus townsendii* and several other North American vespertilionid bats. *Idionycteris* possesses nine pairs of biarmed autosomes and possibly one pair of acrocentric chromosomes deemed to be homologous with those of *Plecotus townsendii.* Four pairs of autosomes are shared with *Myotis, Rhogeessa,* and *Pipistrellus subflavus.* Seven chromosomal fusions are required to derive the karyotype of *Idionycteris* from the karyotype proposed as primitive for the family Vespertilionidae (Baker and Bickham, 1980).

Williams et al. (1970) hypothesized that a single centric fusion resulted in the evolution of the karyotype of *Idionycteris* from that of *Plecotus.* But Bickham (1979) showed that the G-banding data suggested a more complex evolutionary history for these two karyotypes, and he proposed two plausible explanations for the observed autosomal differences between *Idionycteris* and *Plecotus.* The first explanation suggested a common ancestor with 2n = 34 from which the *Plecotus* lineage underwent one fusion of two acrocentric chromosomes while the *Idionycteris* lineage underwent two different fusions of acrocentrics. The second explanation involved an ancestor with 2n = 32, identical autosomally to *Plecotus,* from which the *Idionycteris* complement was derived by one fusion and one translocation.

REMARKS. Much of the literature refers to this bat as *Plecotus phyllotis.* On the basis of the distinctness of its standard karyotype from that of other plecotine bats, Williams et al. (1970) argued for generic recognition of *Idionycteris* separate from its close relative *Plecotus.* However, Karl F. Koopman (Honacki et al., 1982) and Baker et al. (1974) disagree and prefer to retain *Idionycteris* as a subgenus of *Plecotus* unless supportive morphological or other evidence can be shown also. Baker et al. (1974) warned that generic status should not be based on the magnitude of karyological divergence but rather on the origin of the *Idionycteris* karyotype. They stated that if the greater similarity of standard karyotypes between *Idionycteris* and *Euderma* than that between *Idionycteris* and *Plecotus* reflects the origin of the *Idionycteris* karyotype, then karyologic data, at least, would support generic distinction of *Idionycteris.* Until G-banded chromosomes of *Euderma* are published and a comparison of homologous chromosomes shared between it and *Idionycteris* can be made, such data are lacking.

Idionycteris phyllotis also is known in the vernacular as the Mexican big-eared bat.

LITERATURE CITED

Allen, G. M. 1916. Bats of the genus Corynorhinus. Bull. Mus. Comp. Zool., 60:331–356.

Anderson, S. 1972. Mammals of Chihuahua: taxonomy and distribution. Bull. Amer. Mus. Nat. Hist., 148:149–410.

Anthony, H. E. 1923. Mammals from Mexico and South America. Amer. Mus. Novitates, 54:1–10.

Baker, R. J., and J. W. Bickham. 1980. Karyotypic evolution in bats: evidence of extensive and conservative chromosomal evolution in closely related taxa. Syst. Zool., 29:239–253.

Baker, R. J., and J. T. Mascarello. 1969. Chromosomes of some vespertilionid bats of the genera *Lasiurus* and *Plecotus.* Southwestern Nat., 14:249–251.

Baker, R. J., B. L. Davis, R. G. Jordan, and A. Binous. 1974. Karyotypic and morphometric studies of Tunisian mammals: bats. Mammalia, 38:695–710.

Barbour, R. W., and W. H. Davis. 1969. Bats of America. Univ. Press Kentucky, Lexington, 286 pp.

Bickham, J. W. 1979. Chromosomal variation and evolutionary relationships of vespertilionid bats. J. Mamm., 60:350–363.

Black, H. L. 1974. A north temperate bat community: structure and prey populations. J. Mamm., 55:138–157.

Bogan, M. A., and D. F. Williams. 1970. Additional records of some Chihuahuan bats. Southwestern Nat., 15:131–134.

Cain, G. D., and E. H. Studier. 1974. Parasitic helminths of bats from the southwestern United States and Mexico. Proc. Helminthol. Soc. Washington, 41:113–114.

Carter, D. C., R. H. Pine, and W. B. Davis. 1966. Notes on Middle American bats. Southwestern Nat., 11:488–499.

Cockrum, E. L. 1973. Additional longevity records for American bats. J. Arizona Acad. Sci., 8:108–110.

Cockrum, E. L., and B. F. Musgrove. 1964. Additional records of the Mexican big-eared bat, *Plecotus phyllotis* (Allen), from Arizona. J. Mamm., 45:472–474.

Commissaris, L. R. 1961. The Mexican big-eared bat in Arizona. J. Mamm., 42:61–65.

Farney, J. P., and E. D. Fleharty. 1969. Aspect ratio, loading, wing span, and membrane areas of bats. J. Mamm., 50:362–367.

Findley, J. S., and C. J. Jones. 1961. New United States record of the Mexican big-eared bat. J. Mamm., 42:97.

Findley, J. S., E. H. Studier, and D. E. Wilson. 1972. Morphologic properties of bat wings. J. Mamm., 53:429–444.

Findley, J. S., A. H. Harris, D. E. Wilson, and C. Jones. 1975. Mammals of New Mexico. Univ. New Mexico Press, Albuquerque, 360 pp.

Freeman, P. W. 1981. Correspondence of food habits and morphology in insectivorous bats. J. Mamm., 62:162–173.

Gardner, A. L. 1965. New bat records from the Mexican state of Durango. Proc. W. Found. Vert. Zool., 1:101–106.

Geluso, K. N. 1980. Renal form and function in bats: an ecophysiological appraisal. Pp. 403–414, *in* Proc. Fifth Internatl. Bat Res. Conf. (D. E. Wilson and A. L. Gardner, eds.). Texas Tech Press, Lubbock, 434 pp.

Genoways, H. H., and J. K. Jones, Jr. 1967. Notes on distribution and variation in the Mexican big-eared bat, *Plecotus phyllotis*. Southwestern Nat., 12:477–480.

Hall, E. R. 1981. The mammals of North America. Second ed. John Wiley and Sons, New York, 1:1–600 + *90*.

Handley, C. O., Jr. 1959. A revision of American bats of the genera Euderma and Plecotus. Proc. U.S. Natl. Mus., 110: 95–246.

Hayward, B. J., and R. R. Johnson. 1961. Notes on *Plecotus phyllotis* from Arizona. J. Mamm., 42:402.

Honacki, J. H., K. E. Kinman, and J. W. Koeppl (compilers). 1982. Mammal species of the world. A taxonomic and geographic reference. Association of Systematics Collections, Allen Press, Lawrence, Kansas, 704 pp.

Jones, C. 1961. Additional records of bats in New Mexico. J. Mamm., 42:538–539.

— 1965. Ecological distribution and activity periods of bats of the Mogollon Mountains area of New Mexico and adjacent Arizona. Tulane Studies Zool., 12:93–100.

O'Farrell, M. J., and W. G. Bradley. 1969. A new bat record, *Plecotus phyllotis*, from Nevada. J. Mamm., 50:128.

Poche, R. M. 1975. New record of the bat *Plecotus phyllotis* from Utah. Great Basin Nat., 35:452.

Ross, A. 1967. Ecological aspects of the food habits of insectivorous bats. Proc. W. Found. Vert. Zool., 1:205–263.

Simmons, J. A., and M. J. O'Farrell. 1977. Echolocation by the long-eared bat, *Plecotus phyllotis*. J. Comp. Physiol., 122: 201–214.

Simmons, J. A., and R. A. Stein. 1980. Acoustic imaging in bat sonar: echolocation signals and the evolution of echolocation. J. Comp. Physiol., 135A:61–84.

Simmons, J. A., M. B. Fenton, and M. J. O'Farrell. 1979. Echolocation and pursuit of prey by bats. Science, 203:16–21.

Warner, R. M. 1982. A temperate, montane bat community: foraging behavior and morphological correlates. Unpubl. M.S. thesis, Northern Arizona Univ., Flagstaff, 121 pp.

Williams, D. F., and J. S. Findley. 1979. Sexual size dimorphism in vespertilionid bats. Amer. Midland Nat., 102:113–126.

Williams, D. F., J. D. Druecker, and H. L. Black. 1970. The karyotype of *Euderma maculatum* and comments on the evolution of the plecotine bats. J. Mamm., 51:602–606.

Editors for this account were B. J. VERTS and SYDNEY ANDERSON. Managing editor was TIMOTHY E. LAWLOR.

N. J. CZAPLEWSKI, DEPARTMENT OF BIOLOGICAL SCIENCES, BOX 5640, NORTHERN ARIZONA UNIVERSITY, FLAGSTAFF 86011.